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Abstract

MEASUREMENT OF LATTICE PARAMETERS USING A SINGLE FUEL CHANNEL[1/]

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Zink and Rodeback have shown that it is possible to obtain values of thermal utilization, E, and resonance escape probability, p, for a heterogeneous thermal reactor, using a single fuel element embedded in the moderator. This method was tested by using a single uranium fuel channel, 99" long, placed along the axis of a cylindrical assembly of graphite constituting an infinite lattice.

A neutron generator was used to provide a flux of 14 MeV neutrons which were first slowed down by a thermal column. At roughly 10 cm intervals along the axis, graphite rods were inserted radially into the assembly, carrying In foils which measured the In resonance flux φ_{in} at 2 cm intervals along each radius.

In such a case $p_{\infty in} = \int_a^\infty \varphi_{in}\, \gamma\, d\gamma \,/ \int \varphi_{oin}\, \gamma\, d\gamma$ where φ_o is the flux with a non-capturing fuel element, and a is radius of fuel element in an infinite lattice. A dummy (lead) fuel element was substituted to simulate a non-capturing fuel element. Also, fuel elements from UKAEA, which had been used in an exponential experiment giving a known value of buckling, B^2, in a full assembly, were used for calibration purposes.

In the paper, the experimental results of these measurements are described. The thermal utilization was obtained correct to within 1/2%, but resonance escape probability was fouled by streaming and by the fact that the fuel channel was not truly infinite but had an extra source term.

This is an economical and simple method of obtaining parameters which are of great importance for power reactor design and is a logical reduction of the exponential method. It is intended to continue this experiment at the Atomic Energy Centre, Lahore, using a neutron generator and an assembly with water as the moderator.

1/ Work performed at U.C.P. Laboratories London, in collaboration with R. Berenbaum and E.W. Etherington.